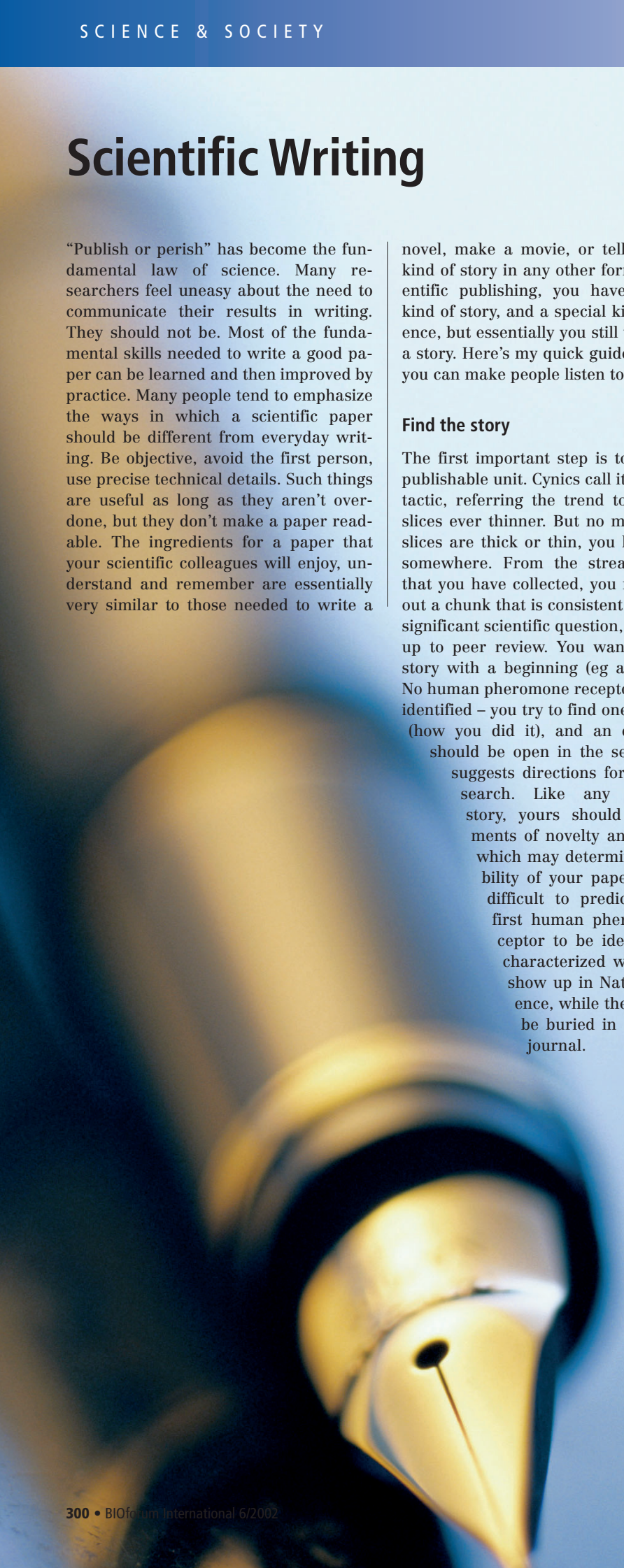
Scientific Writing

"Publish or perish" has become the fundamental law of science. Many researchers feel uneasy about the need to communicate their results in writing. They should not be. Most of the fundamental skills needed to write a good paper can be learned and then improved by practice. Many people tend to emphasize the ways in which a scientific paper should be different from everyday writing. Be objective, avoid the first person, use precise technical details. Such things are useful as long as they aren't overdone, but they don't make a paper readable. The ingredients for a paper that your scientific colleagues will enjoy, understand and remember are essentially very similar to those needed to write a novel, make a movie, or tell any other kind of story in any other format. In scientific publishing, you have a special kind of story, and a special kind of audience, but essentially you still want to tell a story. Here's my quick guide as to how you can make people listen to it.



Find the story

The first important step is to identify a publishable unit. Cynics call it the salami tactic, referring the trend to make the slices ever thinner. But no matter if the slices are thick or thin, you have to cut somewhere. From the stream of data that you have collected, you need to cut out a chunk that is consistent, answers a significant scientific question, and stands up to peer review. You want to find a story with a beginning (eg a challenge: No human pheromone receptor has been identified – you try to find one), a middle (how you did it), and an end, which should be open in the sense that it suggests directions for future research. Like any interesting story, yours should have elements of novelty and surprise, which may determine the visibility of your paper. It is not difficult to predict that the first human pheromone receptor to be identified and characterized will one day show up in Nature or Science, while the 100th will be buried in an obscure journal.

Who's the audience?

Once you have found the story and assessed its qualities, you can start thinking about the audience. The higher the significance of your story, the more general the journal where you can hope to publish it, and the less specialized the audience. If reporting a specific piece of progress to the colleagues in your specific field, you can get away with lots of jargon and little explanations. Writing for Nature, however, you should at least try to make your biology paper understandable to geologists. It's also worth remembering that the high profile journals serve as an interface between science and the general public, as their reports are often picked up by journalists without specific knowledge of the field. Whichever audience you write for, you should ideally be able to name two or three people who you regard as "typical" readers. Later on, you could use these people as guinea pigs to test whether your manuscript actually works for the audience you envisaged.

Finding the right peg

Now that you know who you want to tell your story to, you need to work out how you get them to listen. Chances are that your audience consists of very busy people suffering from severe information overload. To catch their attention, you will have to present a very attractive bait, and it should be very visible in the title and / or in the abstract or first paragraph. In popular science, the peg I hang a story on might well be slightly off-topic, e.g. a cultural cross-reference or some weird observation. In proper scientific papers, in contrast, you will rarely be allowed such digressions, so you need to find the bait within your own work. Think about the most significant, surprising, or spectacular aspect of your work. Try to shape it into a headline or first sentence that you would find irresistible. This is not part of the actual writing process yet, it's more like finding the the departure point for the voyage you still have to pan out in detail.

Outline / structure

You may think that the outline is clear, as it is normally dictated by the author's

guidelines of the journal. e.g.: Introduction, Materials and Methods, Results, Discussion. Still, you should spend some thought on how to divide your story between these parts, and how to structure it within each part. For instance, the introduction could be structured in a way that you zoom in from a short description of the general research context to the specific question you address. The structure of the results section could be organised chronologically, or as a list of different systems studied or methods applied, or it could follow the logical structure of the problem-solving that led you to the answer to your problem . The most compelling papers are of the last type. If you can create a Sherlock-Holmes-style mystery in the introduction and then reveal the clues one by one in the results part, you could coax your audience into actually reading your entire paper, not just the abstract.

Writing it up

With the journey planned, you can now get moving and write up the story. As there is no space here for details of style, I would like to emphasize only one piece of advice: Try to think like a movie director. What do you want to show to your audience, where do you want to direct their attention? This point also covers the dreaded question of passive versus active voice. If you want to attract attention to the hard labour of your team, say: "We cloned and characterized 4,500 mutant strains." If, however, you want the reader to appreciate the beauty of your product, it should take centre stage: "Sparkling blue crystals of rhombohedral shape were obtained in kilogram quantities." My last word on writing is even simpler: Just get it done. In my experience, given that you have done all the previous steps properly, it is best to write up the first draft in one go, as quickly as possible. Don't worry about the details, figures, citations, anything. Just write up your story. You can always edit and improve it later.

Editing and getting published

Once you have a first draft, the editing starts, which can involve anything between one and 100 rounds of reworking the whole thing. At this stage, you need to get all your coauthors to agree with your version of the story, and to seek independent advice from other colleagues. The more people are involved, the longer the editing stage. In my opinion, going through ten versions of a manuscript might still be fruitful. Beyond that, there may come a point where you change things back and forth and generally create more heat than light from the energy you put in. At that point, you should draw a line, decide on a journal (if you haven't done it in the beginning), get the formatting right, and send the thing off. Good luck!

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